



Project Summary

US Army Engineer
Research and Development Center
Waterways Experiment Station

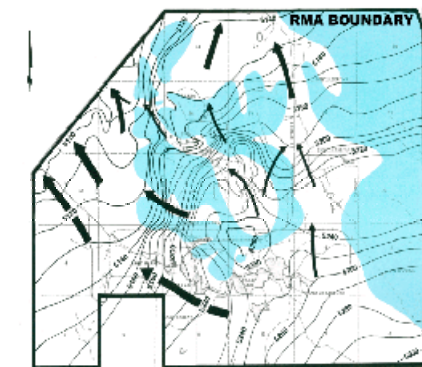
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Hydrogeology Research and Interface with Interdisciplinary Programs

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Problem Statement: Modeling and predicting the movements of groundwater at contaminated sites and in the shallow subsurface historically has proceeded from minimal understanding of the geologic setting in which the groundwater is moving. Subsurface geology seldom fits the perfectly layered conceptual model that is too frequently assumed from sparse or incorrectly interpreted subsurface data. Sophisticated modeling and prediction tools are only as good as the data and interpretations on which they are founded. Thus, interpreting subsurface data in a regional hydrogeologic context has become the key to effective groundwater modeling in many applications.



Arrows indicate groundwater flow paths at Rocky Mountain Arsenal

Environmental Applications of Hydrogeology: Hydrogeology plays a critical role in many of the major research programs conducted at WES. In the environmental arena the cleanup of contaminated groundwater and soils presents a complex and expensive problem. Research into the geologic environments of deposition and how the various geologic materials control migration of contaminants allows the hydrogeologists to make major contributions. For example, certain clays that are impervious to water can allow various chemicals to pass through with ease. Without adequate research into the hydrogeology of a contaminated site, the contaminants cannot be economically treated. Research dealing with enhanced or natural attenuation of contaminants in the subsurface relies on hydrogeologic research to determine if attenuation is a viable option at a given site. A detailed understanding of both hydraulic conductivity distribution and magnitude is critical for a successful attenuation program. An understanding of clay mineralogy and the ability of clays to interact with contaminants is important in predicting rates of attenuation.

The development and maintenance of wetlands requires an in depth knowledge of the processes that are occurring at the groundwater-surface water interface.

Wetlands Applications of Hydrogeology: Thousands of acres in south Florida have been drained for farming and housing needs. Ongoing research to restore the Everglades will, of necessity, be driven by hydrogeologic interpretations. The Everglades are located in a unique geologic environment where the surface water and groundwater are often difficult to distinguish.

DoD Groundwater Modeling Systems (GMS): The development of the Department of Defense GMS is an important research effort. The site conceptualization and geostatistical portions of the GMS are directly related to hydrogeologic research. The application of the GMS at a particular site is dependent on the geology.

Hydrogeology in Current Interdisciplinary Research:

- Groundwater Control Systems Assessments at Rocky Mountain Arsenal - For the past 2 years, quarterly groundwater and chemical concentration data have been analyzed to determine system performance for groundwater control systems at the Northwest Boundary, the North Boundary, Basin A Neck and Off Post. Hydrogeologic conditions change from season to season and with various pumping scenarios.
- Natural Attenuation Demonstration at Louisiana Army Ammunition Plant - The natural attenuation protocol developed at WES is being used to confirm that natural attenuation is occurring at Louisiana Army Ammunition Plant. Numerical modeling using GMS is being used to predict how long attenuation will take.
- The Scaling of Site-Specific Models to a Regional Model at Aberdeen Proving Ground - Numerous site-specific hydrogeologic models have been scaled to a regional conceptual model to serve as a framework for more accurate numerical simulations in the area.
- WES and EPA Natural Attenuation Project, Crane Naval Surface Warfare Center - Dye-tracer tests have been used to determine flow paths in limestone solution cavities. The GMS is being used to visualize the subsurface conditions and model groundwater flow.
- Natural Attenuation Demonstration at Nike Site, Aberdeen Proving Ground - The GMS is being used to visualize the subsurface at a former Nike Missile site and model the attenuation of a TCE plume.
- Natural Attenuation of Explosive Contaminated Groundwater at Site 1, Joliet Army Ammunition Plant, Joliet, IL - Cone penetrometer work, groundwater sampling, and numerical modeling are used to prove that explosives in groundwater are degrading at the Joliet Army Ammunition Plant.
- Three Dimensional Visualization of Epikarst at Fort Campbell, KY - The GMS is used to visualize dye trace and geologic and geophysical data to evaluate pathways for TCE at Fort Campbell.
- Hydrogeologic Conceptualization of South Florida - As part of the effort to restore the Everglades, a three-dimensional hydrogeologic model is being constructed which will serve as the framework for numerical models.